IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): V.K. Goyal et al.
Case: 7-16-1
Serial No.: 09/698,437
Filing Date: October 27, 2000
Group: 2654
Examiner: Vincent P. Harper

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Signature: Teresa M. Hamlin Date: February 27, 2003

Title: Methods and Apparatus for Wireless Transmission Using Multiple Description Coding

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APPEAL BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicants hereby appeal the final rejection dated September 24, 2002 of claims 1-7, 10-18, 21 and 22 of the above-identified application.

REAL PARTY IN INTEREST

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded March 1, 2001 in the U.S. Patent and Trademark Office at Reel 011576, Frame 0033. The assignee Lucent Technologies Inc. is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

STATUS OF CLAIMS

Claims 1-22 are pending in the present application. Each of claims 1-7, 10-18, 21 and 22 stands finally rejected under 35 U.S.C. §103(a). Claims 8, 9, 19 and 20 are indicated as containing allowable subject matter. Claims 1-7, 10-18, 21 and 22 are appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to methods and apparatus for processing a signal for transmission in a wireless communication system.

In accordance with the invention, the signal is first encoded in a multiple description encoder which generates different descriptions of a given portion of the signal. The different descriptions are arranged into packets such that such that at least a first description of the given portion is placed in a first packet and a second description of the given portion is placed in a second packet. The packets are transmitted using a frequency hopping modulator, and a hopping rate of the modulator is configured based at least in part on a number of descriptions generated for each of a plurality of different portions of the signal.

An illustrative embodiment of the invention as shown in FIG. 2 is in the form of a transmitter 102′ comprising a multiple description coder 110 and a frequency hopping modulator 125. The multiple description coder 110 generates two descriptions for each of a plurality of 20-sample groups, where each of the groups corresponds to 2.5 milliseconds of speech, and the frequency hopping rate of the modulator 125 is doubled relative to its single description rate (Specification, page 6, lines 5-8 and page 9, lines 4-24).

With reference to FIG. 5, the specification at page 10, lines 6-16, describes the operation of the illustrative embodiment as follows:

> A number of 20-sample groups are shown in the figure and are denoted A, B, C, D, etc. As previously noted, each of the 20-sample groups in the illustrative embodiment corresponds

to 2.5 milliseconds of speech. For each of the 20-sample groups, two descriptions are generated using the techniques described previously. These two descriptions are denoted for group A as A.1 and A.2, for group B as B.1 and B.2, and so on. A given 2.5 millisecond packet is generated for a current 20-sample group as a combination of the first description for that group and the second description for the previous 20-sample group. For example, the first description B.1 is grouped with the second description A.2 to form a packet, the first description C.1 is grouped with the second description B.2 to form a packet, the first description D.1 is grouped with the second description C.2, and so on.

The invention provides a number of advantages relative to conventional techniques. For example, the specification at page 10, lines 17-23, states as follows with regard to the advantages provided by the illustrative embodiment as described in conjunction with FIG. 5:

> Advantageously, the interleaving strategy of the present invention as illustrated in FIG. 5 does not increase the transmission delay of the system, due to the doubling of the frequency hopping rate. In addition, sending the descriptions for a given group of samples in two different packets prevents the loss of both descriptions if only a single packet is lost. More particularly, a single packet loss results in the loss of the first description of the current 20-sample group, and the second description of the previous 20-sample group. The decoder in this situation can use the received descriptions from another packet to generate a coarse approximation of the input samples.

The present invention is thus directed to a novel and non-obvious combination of multiple description coding with frequency hopping modulation, where the hopping rate is selected or otherwise configured as a function of the number of descriptions generated.

ISSUES PRESENTED FOR REVIEW

1. Whether claims 1, 2, 4, 7, 10-13, 15, 18, 21 and 22 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over an article by Fleming et al. entitled "Generalized Multiple

Descriptive Vector Quantization," (hereinafter "Fleming") in view of U.S. Patent No. 5,048,057 (hereinafter "Saleh").

2. Whether claims 3 and 14 are properly rejected under §103(a) as being unpatentable over Fleming in view of Saleh, an article by Ingle et al. entitled "DPCM System Design for Diversity Systems With Applications to Packetized Speech" (hereinafter "Ingle"), and official notice of allegedly well known prior art.

3. Whether claims 5 and 16 are properly rejected under §103(a) as being unpatentable over Fleming in view of Saleh and an article by Vaishampayan entitled "Design of Multiple Description Scalar Quantizers" (hereinafter "Vaishampayan").

4. Whether claims 6 and 17 are properly rejected under §103(a) as being unpatentable over Fleming in view of Saleh and official notice of allegedly well known prior art.

GROUPING OF CLAIMS

With regard to Issue 1, claims 1, 2, 4, 7, 12, 13, 15 and 18 stand or fall together, claims 10 and 21 stand or fall together, and claims 11 and 22 stand or fall together.

With regard to Issue 2, claims 3 and 14 stand or fall together.

With regard to Issue 3, claims 5 and 16 stand or fall together.

With regard to Issue 4, claims 6 and 17 stand or fall together.

ARGUMENT

Issue 1

Applicants initially note that MPEP §706.02(j) specifically states as follows with regard to the burden that the Examiner must meet in order to establish a proper §103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the

claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Applicants respectfully submit that the Examiner has not established a *prima facie* case of obviousness in the present §103(a) rejections. More particularly, the Examiner has failed to meet one or more of the above-noted basic criteria, for the reasons outlined below.

The present invention as set forth in independent claims 1 and 12 is directed to a signal processing method and apparatus, respectively, in which a signal is encoded in a multiple description decoder which generates a plurality of different descriptions of a given portion of the signal. These claims also include substantially the following limitations:

(i) the different descriptions of the given portion of the signal are arranged into packets such that at least a first description of the given portion is placed in a first packet and a second description of the given portion is placed in a second packet; and

(ii) the packets are transmitted using a frequency hopping modulator, wherein a hopping rate of the modulator is configured based at least in part on a number of descriptions generated for each of a plurality of different portions of the signal.

As indicated previously herein, an illustrative embodiment of the invention falling within the above-noted limitations of claims 1 and 12 is described in the specification, at page 9, lines 11-24, as follows, with emphasis supplied:

> As noted previously, in the illustrative embodiment as shown in FIG. 2, the frequency hopping modulator 125 periodically hops in frequency. One possible single description implementation of the modulator 125 in a cordless telephone application hops among 25 different frequencies $\{f_n\}$, where $n = 1, 2, \ldots 25$, using a hopping period of 125 milliseconds. Each 5 millisecond speech segment in such an application is thus sent in a different packet on a different frequency. The modulator 125 thus cycles through the 25 hopping frequencies in each 125 millisecond hopping period in the single description case.

The present invention provides a multiple description interleaving strategy that involves configuring the frequency hopping rate of the modulator 125 for transmission of the previously-described multiple descriptions. In order to avoid an increase in the transmission delay, the frequency hopping rate used for transmission of the multiple descriptions in the illustrative embodiment is doubled relative to the hopping rate used for the above-noted single description implementation. Consecutive input samples are separated into groups of 20 samples. A given packet is generated using the samples associated with a first description of a current 20-sample group and the samples associated with a second description of the previous 20-sample group. Each packet is still transmitted using a particular one of the 25 frequencies, but the packet is configured in the manner described above to include a first description of a current group of samples and a second description of a previous group of samples. In other words, the first description of the current 20-sample group is sent in the current packet, and the second description is delayed and sent with the next packet. The frequency hopping rate is doubled, such that the frequency hopping period for the illustrative embodiment is reduced to 62.5 milliseconds.

The Examiner in formulating the §103(a) rejection of independent claims 1 and 12 argues that the claimed invention is obvious even though at least limitation (ii) above is not explicitly disclosed by either Fleming or Saleh.

Applicants submit that there is no motivation to combine Fleming and Saleh in the manner urged by the Examiner. For example, there is no mention in Fleming of a frequency hopping modulator or the desirability of using such a modulator for transmission of multiple descriptions in the manner claimed. Similarly, there is no mention in Saleh regarding multiple descriptions or their use in conjunction with a frequency hopping modulator in the manner claimed. The Examiner has therefore failed to establish the first of the criteria specified in MPEP §706.02(j), that is, has failed to identify some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the reference teachings. The Examiner instead relies upon impermissible hindsight to reconstruct the present invention from unrelated references.

Moreover, even if one were to assume, for purposes of argument, that the Fleming and Saleh references are combinable in the manner urged by the Examiner, the combination would fail to meet at least limitation (ii) above.

The Examiner argues that column 1, lines 45-65 of Saleh read on limitation (ii) above, despite the fact that Saleh makes no mention of multiple descriptions and multiple descriptions are a requirement of the limitation. The cited portion of Saleh teaches nothing beyond conventional frequency hopping modulation. There is no discussion or suggestion regarding limitation (ii) of the claimed invention, in which the frequency hopping rate of the modulator is configured based on the number of descriptions generated in multiple description encoding. The combination proposed by the Examiner therefore fails to meet certain limitations of claims 1 and 12, and therefore fails to meet the third and final criterion specified in MPEP §706.02(j).

To summarize, independent claims 1 and 12 in limitation (ii) above require that the hopping rate of the modulator be configured based on the number of descriptions generated in a multiple description encoding process. The Examiner has combined a pair of references, one a multiple description reference with no mention of frequency hopping and the other a frequency hopping reference with no mention of multiple descriptions, in an attempt to recreate the present invention based on the benefit of hindsight and without identifying a cogent motivation for the combination. Moreover, even if one were to assume for purposes of argument that the references are combinable, the combination fails to meet at least limitation (ii) above.

The Examiner at pages 11-12, section 11 of the final Office Action states as follows in support of his obviousness rejection of claims 1 and 12 over Fleming and Saleh, with the emphasis being in the original:

> Moreover, Saleh indicates that the combination of frequency hopping with <u>some form of channel coding</u> has been proposed and relates to the (Saleh's) described invention (col. 1, lines 39-35 [sic]). In addition, Saleh motivates this combination by suggesting it might be an effective counter to fading and interference (col. 1, 29-30). Since multiple description coding is a coding technique used to reduce information loss during transmission (Fleming,

§1), the Examiner contends that the combination is both suggested and motivated by the prior art.

Applicants respectfully disagree with the contention of the Examiner on this point. The portions of Saleh relied upon by the Examiner to support this contention state as follows, with emphasis supplied:

> Various techniques have been proposed to counter the fading and interference problems. For example, antenna diversity has been proposed to counteract fading. In addition, to counter both fading and interference, the use of direct sequence spread spectrum transmission or frequency hopping - possibly combined with some form of conventional channel coding - has been proposed.

This teaches nothing more than that channel coding in general may be desirable to utilize in conjunction with frequency hopping. It is not sufficient motivation for the particular combination proposed, that is, a combination of Saleh with a multiple description coding reference. Where is the suggestion to use multiple description coding in particular rather than convolutional coding, block coding, or other type of single description coding?

The Federal Circuit has stated that when patentability turns on the question of obviousness, the obviousness determination "must be based on objective evidence of record" and that "this precedent has been reinforced in myriad decisions, and cannot be dispensed with." In re Sang-Su Lee, 277 F.3d 1338, 1343 (Fed. Cir. 2002). Moreover, the Federal Circuit has stated that "conclusory statements" by an examiner fail to adequately address the factual question of motivation, which is material to patentability and cannot be resolved "on subjective belief and unknown authority." Id. at 1343-1344.

Applicants submit that the Examiner has failed to demonstrate an adequate motivation for the particular combination proposed, and instead provides a conclusory statement of obviousness based on the type of "subjective belief and unknown authority" that the Federal Circuit has indicated as providing insufficient support for an obviousness rejection. More specifically, the statement in

Saleh to the effect that "some form of conventional channel coding may be used" in conjunction with frequency hopping fails to provide adequate motivation to combine Saleh with Fleming. The Examiner instead appears to be making the connection between this statement in Saleh and the Fleming reference based solely on Applicants' disclosure, and not on any "objective evidence of record." In other words, the Examiner is reconstructing Applicants' claimed invention based on impermissible hindsight.

Dependent claims 2, 4, 7, 10, 11, 13, 15, 18, 21 and 22 are believed allowable for at least the reasons identified above with regard to their respective independent claims. Moreover, each of the claim pairs 10 and 21, and 11 and 22 is believed to define separately patentable subject matter, as outlined below.

With regard to claims 10 and 21, these claims specify that two descriptions are generated for each of a plurality of different portions of the signal, with a first one of the descriptions for a current one of the portions of the signal being placed in a current packet along with a second one of the descriptions for a previous portion of the signal. These claims thus incorporate particular limitations of the two-description example in the illustrative embodiment of the invention cited above, and are not taught or suggested by the cited references. The Examiner in rejecting these claims does not rely on specific teachings from the references, but instead upon subjective belief, which as noted above fails to meet the criteria for a proper §103(a) rejection.

With regard to claims 11 and 22, these claims specify that the hopping rate of the frequency hopping modulator is selected such that a transmission delay of the system is not increased as a result of the transmission of the plurality of descriptions relative to a transmission delay of the system for single description transmission. Applicants submit that such an arrangement is not taught or suggested by the proposed combination of Fleming and Saleh. The Examiner acknowledges that Fleming fails to meet the limitations of claims 11 and 22, but argues that sufficient teachings are provided in column 2, lines 2-7 of Saleh (Final Office Action, page 7, first paragraph). However, this portion of Saleh simply refers to reducing the hopping rate under certain conditions. It does not teach or suggest the particular limitations in question.

Issue 2

Applicants submit that claims 3 and 14 are allowable for at least the reasons identified above with regard to their respective independent claims. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Ingle reference and the allegedly well known prior art fail to supplement the fundamental deficiencies of the proposed combination of Fleming and Saleh.

Issue 3

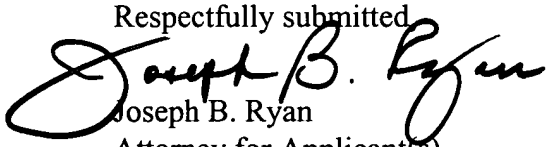
Applicants submit that claims 5 and 16 are allowable for at least the reasons identified above with regard to their respective independent claims. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Vaishampayan reference fails to supplement the fundamental deficiencies of the proposed combination of Fleming and Saleh.

Issue 4

Applicants submit that claims 6 and 17 are allowable for at least the reasons identified above with regard to their respective independent claims. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The allegedly well known prior art fails to supplement the fundamental deficiencies of the proposed combination of Fleming and Saleh.

In view of the foregoing, Applicants believe that claims 1-7, 10-18, 21 and 22 are in condition for allowance, and respectfully request the withdrawal of the §103(a) rejections.

Respectfully submitted,



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APPENDIX

1. A method of processing a signal for transmission in a wireless communication system, the method comprising the steps of:

encoding the signal in a multiple description coder which generates a plurality of different descriptions of a given portion of the signal;

arranging the different descriptions of the given portion of the signal into packets such that at least a first description of the given portion is placed in a first packet and a second description of the given portion is placed in a second packet; and

transmitting each of the packets using a frequency hopping modulator, wherein a hopping rate of the modulator is configured based at least in part on a number of descriptions generated for each of a plurality of different portions of the signal.

2. The method of claim 1 wherein the multiple description coder comprises a multiple description coder configured to implement multiple description scalar quantization (MDSQ).

3. The method of claim 1 wherein the multiple description coder comprises a multiple description adaptive differential pulse code modulation (ADPCM) coder.

4. (Amended) The method of claim 1 wherein each of the portions of the signal corresponds to a designated segment of the signal having a particular time duration.

5. The method of claim 1 wherein the signal comprises a speech signal.

6. The method of claim 1 wherein the wireless communication system comprises a cordless telephone system.

7. The method of claim 1 wherein the frequency hopping modulator is configured such that each of the packets is transmitted using a different frequency.

8. The method of claim 1 wherein the hopping rate of the frequency hopping modulator is selected as twice a frequency hopping rate of the modulator used for transmission of a single description of the given portion of the signal.

9. The method of claim 1 wherein a packet size for the first and second packets is selected as one-half a packet size used for transmission of a single description of the given portion of the signal.

10. The method of claim 1 wherein the encoding step generates two descriptions for each of a plurality of different portions of the signal, with a first one of the descriptions for a current one of the portions of the signal being placed in a current packet along with a second one of the descriptions for a previous portion of the signal.

11. The method of claim 1 wherein the hopping rate of the frequency hopping modulator is selected such that a transmission delay of the system is not increased as a result of the transmission

of the plurality of descriptions relative to a transmission delay of the system for single description transmission.

12. An apparatus for processing a signal for transmission in a wireless communication system, the apparatus comprising:

a multiple description coder operative to generate a plurality of different descriptions of a given portion of the signal, the different descriptions of the given portion of the signal being arranged into packets such that at least a first description of the given portion is placed in a first packet and a second description of the given portion is placed in a second packet; and

a frequency hopping modulator having an input coupled to an output of the multiple description coder and operative to configure the packets for transmission, wherein a hopping rate of the modulator is configured based at least in part on a number of descriptions generated for each of a plurality of different portions of the signal.

13. The apparatus of claim 12 wherein the multiple description coder comprises a multiple description coder configured to implement multiple description scalar quantization (MDSQ).

14. The apparatus of claim 12 wherein the multiple description coder comprises a multiple description adaptive differential pulse code modulation (ADPCM) coder.

15. (Amended) The apparatus of claim 12 wherein each of the portions of the signal corresponds to a designated segment of the signal having a particular time duration.

16. The apparatus of claim 12 wherein the signal comprises a speech signal.

17. The apparatus of claim 12 wherein the wireless communication system comprises a cordless telephone system.

18. The apparatus of claim 12 wherein the frequency hopping modulator is configured such that each of the packets is transmitted using a different frequency.

19. The apparatus of claim 12 wherein the hopping rate of the frequency hopping modulator is selected as twice a frequency hopping rate of the modulator used for transmission of a single description of the given portion of the signal.

20. The apparatus of claim 12 wherein a packet size for the first and second packets is selected as one-half a packet size used for transmission of a single description of the given portion of the signal.

21. The apparatus of claim 12 wherein the multiple description coder generates two descriptions for each of a plurality of different portions of the signal, with a first one of the descriptions for a current one of the portions of the signal being placed in a current packet along with a second one of the descriptions for a previous portion of the signal.

22. The apparatus of claim 12 wherein the hopping rate of the frequency hopping modulator is selected such that a transmission delay of the system is not increased as a result of the transmission of the plurality of descriptions relative to a transmission delay of the system for single description transmission.